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### (54) Lock nut assemblies.

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### Description

This invention relates to lock nut assemblies and in particular to lock nut assemblies for use in applications such as aircraft actuators.

Until now lock nut assemblies have usually comprised a castellated nut used in conjunction with a bolt and a split pin. The bolt has a radially extending hole through its threaded end so that when the nut has been tightened on the bolt to the required torque a split pin may be passed through the hole and one of the gaps between the castellations aligns with the hole to prevent subsequent rotation of the nut.

The main problem with the split pin arrangement is that the strength and reliability of the lock nut assembly is dependent on the shear strength of the split pin. If for any reason the split pin should shear the nut may unscrew from the end of the bolt and cause parts which were previously fastened together to fall apart. Another disadvantage is that during assembly, when the nut has been tightened to the required torque, the gaps of the castellations do not always align exactly with the hole in the bolt and the nut must then either be over-tightened or slackened off until alignment is achieved to allow the split pin to be inserted. This is unsatisfactory particularly if it results in a large torque error with respect to the desired torque. A method of overcoming this problem is to assemble the bolt through the parts to be joined, tighten the nut on the bolt to the required torque and then drill in situ a hole through the nut, which need not be castellated. The split pin may then be inserted. However, even this solution is not always satisfactory, especially in aircraft where space is very limited and parts are difficult to reach to drill through accurately. Even if the nut and bolt can be drilled through accurately in situ the resulting swarf can fall into inaccessible places inside the aircraft where it can cause damage if it is not removed. Even when fitted, the split pin and castellated nut will always suffer from a small amount of backlash, except in the instance where the hole is drilled in situ.

Another problem common to castellated nuts is that they have a large profile and/or diameter and if they are installed on moving parts, such as mechanical linkages, within an aircraft, the edges of the nut and bolt protrude and may sometimes catch against or cut other internal parts of the aircraft.

A bolt and nut lock mechanism is known from US-A-1 467 824 (Ahlers) in which a sleeve bolt having a hollow shank is threadedly engaged by a locking bolt extending in the hollow shank, with the free end of the locking bolt threadedly secured by a clamp bolt (nut) extending through a tapering aperture in the head of the sleeve bolt. The shank of the clamp bolt is tapered complementarily to the tapering aperture in the head of the sleeve bolt. The frictional engagement of the tapering surfaces do not provide the security of resistance against inadvertent loosening in all the situa-

tions that may occur in practice, e.g. a high vibration environment such as is encountered in aircraft applications.

It is an object of the present invention to provide

- 5 a lock nut assembly which overcomes the problems of the conventional castellated nut and which has a smaller, flatter profile. Furthermore it is an object of this invention to provide a lock nut assembly which can be accurately pre-set to the required torque and which can be locked into place without backlash and without the need to drill holes in situ.

According to one aspect of the present invention a lock nut assembly comprises a sleeve bolt, a clamp bolt and a locking bolt for securing parts together in a manner resisting loosening,

said sleeve bolt including a hollow shank with an internally threaded portion at its free end, a head, an internal bore extending between said head and said threaded portion, said head being formed with a central aperture aligned with said internal bore,

said clamp bolt also having a hollow shank and including an internally threaded portion at one end and a head portion at its opposite end,

and a locking bolt which has an externally threaded portion at one end and a head portion at its opposite end,

wherein said internally threaded portion of the shank of the clamp bolt and the externally threaded portion of the locking bolt are dimensioned for co-operation with threads of one hand,

characterised in that

a portion of the bore of said sleeve bolt adjacent its head is externally threaded;

in that the said clamp bolt has at its said one

35 end an internally threaded portion,

wherein said externally threaded portion of the clamp bolt and said internally threaded portion of the said sleeve bolt are dimensioned for co-operation with threads of the opposite hand relative to the co-operating threads of the said threaded portions of the clamp bolt and locking bolt,

whereby, in use, the clamp bolt may be screwed into the sleeve bolt, the locking bolt may be screwed into the clamp bolt via the hollow shank of the sleeve bolt and, because of the opposite handedness of the respective co-operating threads, the assembly will resist any tendency to undo.

According to another aspect of the invention, there is provided a lock nut assembly which is as claimed in claim 6.

Preferably, the head portions of the sleeve, clamp and locking bolt are multi-facetted head portions to facilitate tightening by spanner or the like.

Preferably, the head portion of the locking bolt is

55 wired to or otherwise secured to the sleeve bolt after tightening further to resist any tendency for the assembly to undo.

Specific embodiments of the invention will now b

described by way of example only and with reference to the accompanying drawings of which:-

Figure 1 is a cross-sectional view through a lock nut assembly according to a first embodiment of the present invention;

Figure 1a is a plan view of the assembly of Figure 1;

Figures 1b and 1c respectively illustrate components of the assembly of Figure 1, in elevation and on a reduced scale;

Figures 2 and 2a respectively correspond to Figures 1 and 1a but illustrate an alternative embodiment of the invention;

Figures 3 and 3a respectively correspond to Figures 1 and 1a but illustrate another preferred embodiment of the invention, with Figures 3b to 3d respectively illustrating components of the assembly of Figure 3, in elevation; and

Figures 4 and 4a are views through a further embodiment of the present invention, respectively corresponding to Figures 1 and 1a.

Figures 1 to 1d show a lock nut assembly comprising a hollow sleeve bolt 1 which has an axially extending bore 2 through it. The bolt 1 has a hexagonal head portion 3 with a central aperture aligned with the bore 2 and an adjacent internally threaded portion 4 at one end. An internally threaded portion 5 is provided at the opposite end of the bolt 1.

The locking mechanism for the bolt 1 comprises a clamp bolt 6 and a locking bolt 7; the shanks of both these bolts 6, 7 may be passed through the bore 2 of sleeve bolt 1. The clamp bolt 6 (Fig. 1b) has a low profile torque-adjusting hexagonal head portion 8, an externally threaded central portion 9 and an internally threaded end portion 10 remote from the head portion 8.

The locking bolt 7 (Fig. 1c) has a hexagonal head 11 at one end and an externally threaded portion 12 at the other end. Threaded portions 9 and 12 of the clamp bolt 6 and the locking bolt 7 respectively, are of opposite thread to each other. Similarly, the threaded portion 5 of sleeve bolt 1 and the threaded portion 10 of clamp bolt 6, respectively are of opposite thread to each other. The head portion 11 of the locking bolt 7 has a small transverse bore 13 through which a retaining wire 14 may be passed, see Fig. 1a.

The whole lock nut assembly is shown in situ through a portion of aircraft linkage. The linkage comprises a central portion 15 which is rotatably mounted on bearing surfaces 16 about the circumference of the sleeve bolt 1. A yoked portion 17 of the linkage is attached to the ends of the sleeved bolt 1 by means of bushings 18. During assembly of the linkage the central portion 15 is placed between yoked portion 17 until the bearing 16 is coaxially aligned with the bushings 18. The sleeve bolt 1 is then inserted through the bushings 18 and bearing 16, thereby pinning the linkage together when the sleeve bolt 1 is in place. The

sleeve bolt 1 is inserted into the bearing 16 by using an insertion tool (not shown) which is screwed into the threaded portion 4 of the sleeve bolt 1 and is used to draw the sleeve bolt 1 into the bearing 16. The same tool can be used for extracting the sleeve bolt 1 from the bearing 16 during later maintenance or replacement of the bearing parts. The threaded portion 4 of the sleeve bolt 1 is used solely for insertion and extraction of the sleeve bolt 1 and does not in any way co-operate with the shank of the locking bolt 7. The threaded portion 9 of the clamp bolt 6 is screwed into the threaded portion 5 in the end of the sleeve bolt 1 by means of the torque-adjusting head portion 8.

Torque spanners of the appropriate sizes are then placed on each of the head portions 3 and 8 and the clamp bolt 6 is tightened to the required torque. The two hexagonal head portions 3 and 8 constrain the sleeve bolt 1 in the yoked portion 17 of the linkage. When the clamp bolt 6 has been tightened to the required torque the locking bolt 7 is placed through the aperture of the hexagonal head portion 3 and into the bore 2 of the sleeve bolt 1 and the external threaded portion 12 of locking bolt 7 is screwed tightly into the internal threaded portion 10 of the clamp bolt 6 by means of the hexagonal head portion 11. When the locking bolt 7 has been tightened, the hexagonal head portion 8 of bolt 6 cannot accidentally rotate undone (slacken) under the influence of vibration of successive movements of the linkage. Any tendency of the clamp bolt 6 to rotate in an unlocking direction will be resisted by virtue of the opposite handedness of the threaded portions 9 and 5. Should the clamp bolt 6 be subjected to forces which tend to rotate it so as to unscrew co-operating threaded portions 9 and 5, the tendency will be resisted by the interengagement of the oppositely threaded portion 10 of the clamp bolt 6 and the co-operating thread 12 of the locking bolt 7.

The lock nut assembly described is much stronger than conventional castellated nut and split pin arrangements because, unlike the split pin of such known arrangements, the bolt 7 embodied in this invention is not subjected to shear forces. The threaded portions 10 and 12 effectively eliminate the need for a castellated nut with the added advantages that

(i) the threads allow a continuous range of torque to be applied to the bolt, and

(ii) all backlash is substantially eliminated when the lock nut is tightened, unlike the conventional castellated nut which is limited to a series of discrete settings available from the castellations.

Because a large portion of the clamp bolt 6 protrudes inside the sleeve bolt 1 the head portion 8 can be made very thin to fit fairly closely against the surface of the yoked portion 17 of the linkage. In a conventional arrangement the castellated nut would protrude from the yoked portion 17 to a much greater extent and the threaded portion of the corresponding bolt

would protrude externally of the yoke with the castellated nut separately bolted on, unlike the present invention, and will cause problems of snagging and abrasion.

As an additional safety measure a locking wire 14 is used to fasten the head 11 of the locking bolt 7 to the bolt head 3 of the sleeve bolt 1. The wire is threaded through the bore 13 of the head 11 of bolt 7 and is tied around the two bolt heads 11 and 3, as shown in the plan view of Figure 1a. The wire 14 further prevents any tendency of the locking bolt 11 to undo and retains the locking bolt 7 inside the sleeve bolt 1.

Figures 2 and 2a, Figures 3 to 3d and Figures 4 and 4a, respectively, show alternative arrangements for retaining the locking bolt 7 to the sleeve bolt 1. In all other respects the embodiments remain the same as that shown in Figure 1 as does the basis of its operation and the same reference numbers designate the same or functionally equivalent parts.

If only a single wire 14 is used there is always a chance that during assembly the wire might be fastened the wrong way around the bolt heads in which case the locking bolt 7 will not be constrained by the sleeve bolt 1. For instance, when the locking bolt 7 is subjected to forces which urge it to rotate undone, instead of becoming taut and constraining the locking bolt head 3 the locking wire 14 will become slack and will no longer constrain the locking bolt 1.

To overcome this problem the embodiment of Figures 2 and 2a is provided, wherein a set of two wires 14 is used to tie bolt head 11 to bolt head 3. The two wires are tied in opposite directions and this ensures that the bolt 1 cannot be accidentally wired the wrong way round.

Figures 3 and 3a to 3d show another arrangement for retaining the locking bolt 7. In this embodiment, the head portion 11 of the locking bolt 7 is chamfered and a broached retaining washer 19 is placed over the top of both the bolt heads 11 and 3. The broached retaining washer 19 has a dodecahedral hole 20 through its middle which fits over the head of the bolt 11 and the side of the retaining washer 19 has three tabs 21 which fit over the sides of the hexagonal head 3 of the sleeve bolt 1 and prevent rotation of the locking bolt 7 with respect to the sleeve bolt 1. The broached retaining washer 19 is itself retained by a split pin 22 which is placed through a bore 23 in the hexagonal headed portion 11 of the locking bolt 7. The broached retaining washer 19 prevents the split pin 22 from being subjected to any shear loads because it prevents rotation of the locking bolt 7 with respect to the sleeve bolt 1. The split pin 22 only serves to retain the broached retaining washer 19 in position and is not subjected to any forces at all. A drawback with this arrangement, however, is that it has the same limitations as a conventional castellated nut arrangement and can only be tightened through a series of discrete

settings and not through a continuous range.

Figures 4 and 4a show an alternative embodiment for fixing a split pin into the end of the sleeve bolt 1 which achieves a very low profile. The head portion 11 of the locking bolt 7 is of chess head form with a diametral slot 24 for co-operation with a screwdriver. The head also has a circumferential groove 25 machined around its edge with which a split pin 26 cooperates. When the locking bolt 7 is tightened into the clamp bolt 6 the head portion 11 of the locking bolt 7 is countersunk into the head 3 of the sleeve bolt 1 inside a cylindrical recess 27 in head 3. Split pin 26 is then placed through a bore 28 in the side of the head portion 3 so that it engages with the groove 25 in the edge of the chess head 11 to retain the locking bolt 7 in the sleeve bolt 1. The split pin 26 prevents axial movement of the locking bolt 7 within the sleeve bolt 1 and in so doing prevents the locking bolt 7 from rotating undone. The split pin 26 is offset from the centre of the bolt head 11 to reduce shear forces across the split pin 26. This split pin arrangement eliminates the need to use locking wire and enables a tidier flush fitting to be achieved.

Although only a few specific embodiments of the invention have been disclosed other embodiments are possible without departing from the scope of the invention as defined in the claims. For example, the invention need not be limited to use with spherical bearings as shown in the Figures but could for example be used with a plain journal, needle bearings or any other type of bearing.

## Claims

- 35 1. A lock nut assembly comprising a sleeve bolt (1), a clamp bolt (6) and a locking bolt (7) for securing parts together in a manner resisting loosening,  
said sleeve bolt (1) including a hollow shank  
40 with an internally threaded portion (5) at its free end,  
a head (3), an internal bore (2) extending between  
said head (3) and said threaded portion (5), said head (3) being formed with a central aperture aligned with  
said internal bore (2),  
45 said clamp bolt (6) also having a hollow shank  
and including an internally threaded portion (10) at one end and a head portion (8) at its opposite end,  
and a locking bolt (7) which has an externally  
threaded portion (12) at one end and a head portion (11) at its opposite end,  
50 wherein said internally threaded portion (10) of  
the shank of the clamp bolt (6) and the externally  
threaded portion (12) of the locking bolt (7) are dimensioned for co-operation with threads of one hand,  
55 characterised in that a portion (4) of the bore  
(2) of said sleeve bolt (1) adjacent its head (3) is internally threaded;  
in that the said clamp bolt (6) has at its said on

end an externally threaded portion (9),

wherein said externally threaded portion (9) of the clamp bolt (6) and said internally threaded portion (4) of the said sleeve bolt (1) are dimensioned for co-operation with threads of the opposite hand relative to the co-operating threads of the said threaded portions (10, 12) of the clamp bolt (6) and locking bolt (7),

whereby, in use, the clamp bolt (6) may be screwed into the sleeve bolt (1), the locking bolt (7) may be screwed into the clamp bolt (6) via the hollow shank of the sleeve bolt (1) and, because of the opposite handedness of the respective co-operating threads, the assembly will resist any tendency to undo.

2. An assembly as claimed in claim 1 characterised in that the head portion (11) of the locking bolt (7) is wired (14) or otherwise secured to the sleeve bolt (1) after tightening.

3. An assembly as claimed in claim 2 characterised in that the said head portion (11) is wired by two mutually oppositely directed wires (14). (Fig. 2a)

4. An assembly as claimed in claim 2 characterised in that said head portion (11) is chamfered and a shaped retaining washer (19) is placed over it as well as over the head portion (3) of the sleeve bolt (1), said washer (19) being retained by a split fastener (22).

5. An assembly as claimed in claim 1 characterised in that the head portion (11) of the locking bolt (7) is of cheese head form and has a circumferential edge groove (25) for co-operation with a split pin (26).

6. A lock nut assembly comprising a bolt (1) for securing parts together in a manner resisting loosening, said bolt (1) including a hollow shank with a threaded portion (5), an internal bore (2) and a head (3) formed with a central aperture aligned with said internal bore (2), the said internal bore (2) being provided with a threaded portion (4), and locking means (6, 7) for said shank,

characterised in that said locking means comprises a first, threaded member (6) and a second threaded member (7) which threadedly engages the first threaded member (6), said first threaded member (6) having a threaded portion (9) which engages the said threaded portion (5) of said shank, the said threaded portion (9) of said first member (6) and the threaded portion (4) of said internal bore (2) being dimensioned for co-operation with threads of the opposite hand relative to the co-operating threaded portions of the said first and second members (6, 7), whereby any relative rotation between the said threaded portion (4) of said shank and a given one of said threaded members (6, 7) engaged therewith is opposed by the threaded engagement between the said first and second threaded members (6, 7).

## Patentansprüche

1. Baueinheit mit Sich rungsmutt r, mit einer Hülsenschraube (1), einer Spannschraube (6) und einer Verriegelungsschraube (7), zum sicheren Verbinden von Teilen in einer dem Lösen widerstehenden Weise,

wobei die besagte Hülsenschraube (1) einen hohlen Schaft mit an seinem freien Ende einem mit Innengewinde versehenen Abschnitt (5), einen Kopf (3) und eine innere Bohrung (2) aufweist, die sich zwischen besagtem Kopf (3) und dem besagten mit Gewinde versehenen Abschnitt (5) erstreckt, wobei der besagte Kopf (3) mit einer zentrischen Öffnung ausgebildet ist, die mit der besagten inneren Bohrung (2) fluchtet,

wobei die besagte Spannschraube (6) ebenfalls einen hohlen Schaft aufweist und an einem Ende einen mit Innengewinde versehenen Abschnitt (10) umfaßt, sowie einen Kopfabschnitt (8) an ihrem gegenüberliegenden Ende,

sowie einer Verriegelungsschraube (7), die einen mit Außengewinde versehenen Abschnitt (12) an einem Ende und einen Kopfabschnitt (11) an ihrem gegenüberliegenden Ende hat,

wobei der besagte mit Innengewinde versehene Abschnitt (10) des Schafes der Spannschraube (6) und der mit Außengewinde versehene Abschnitt (12) der Verriegelungsschraube (7) ausgelegt sind, um mit Gewinden einer Steigungsrichtung zusammenzuwirken,

dadurch gekennzeichnet,  
daß ein Abschnitt (4) der Bohrung (2) der besagten Hülsenschraube (1) anschließend an ihren Kopf (3) mit Innengewinde versehen ist,

daß die besagte Spannschraube (6) an ihrem besagten einen Ende einen mit Außengewinde versehenen Abschnitt (9) hat,

wobei der besagte mit Außengewinde versehene Abschnitt (9) der Spannschraube (6) und der mit Innengewinde versehene Abschnitt (4) der besagten Hülsenschraube (1) ausgelegt sind, um mit Gewinden der bezüglich der zusammenwirkenden Gewinde der besagten mit Gewinde versehenen Abschnitte (10, 12) der Spannschraube (6) und der Verriegelungsschraube (7) entgegengesetzten Steigungsrichtung zusammenzuwirken,

wobei beim Gebrauch die Spannschraube (6) in die Hülsenschraube (1) geschraubt werden kann, die Verriegelungsschraube (7) durch den hohen Schaft der Hülsenschraube (1) in die Spannschraube (6) geschraubt werden kann und,

wegen der entgegengesetzten Steigungsrichtung der entsprechenden zusammenwirkenden Gewinde, die Baueinheit jeder Tendenz zum Lösen widerstehen wird.

2. Baueinheit gemäß Anspruch 1, dadurch gekennzeichnet, daß der Kopfabschnitt (11) der Ver-

riegelungsschraube (7) nach dem Festziehen mit der Hülsenschraube (1) verdrahtet (14) oder zweitig gesichert ist.

3. Baueinheit gemäß Anspruch 2, dadurch gekennzeichnet, daß der besagte Kopfabschnitt (11) mit zwei gegenseitig entgegengesetzten gerichteten Drähten (14) verdrahtet ist (Fig. 2a).

4. Baueinheit gemäß Anspruch 2, dadurch gekennzeichnet, daß der besagte Kopfabschnitt (11) abgeschrägt ist und eine geformte Rückhaltescheibe (19) sowohl über ihn als auch über den Kopfteil (3) der Hülsenschraube (1) angebracht wird, wobei die besagte Scheibe (19) durch einen Splint (22) gehalten wird.

5. Baueinheit gemäß Anspruch 1, dadurch gekennzeichnet, daß der Kopfabschnitt (11) der Verriegelungsschraube (7) zylinderschraubenartig ist und eine umlaufende Nut (25) hat zum Zusammenwirken mit einem Splint (26).

6. Baueinheit mit Sicherungsmutter, die eine Schraube (1) umfaßt zum sicheren Zusammenfügen von Teilen in einer dem Lösen widerstehenden Weise, wobei die besagte Schraube (1) einen hohlen Schaft mit einem mit Gewinde versehenen Abschnitt (5) aufweist, eine innere Bohrung (2) und einen Kopf (3), der mit einer zentrischen Öffnung ausgebildet ist, die mit der besagten inneren Bohrung (2) fluchtet, wobei die besagte innere Bohrung (2) mit einem mit Gewinde versehenen Abschnitt (4) versehen ist, sowie Verriegelungsmitteln (6, 7) für besagten Schaft,

dadurch gekennzeichnet, daß die Verriegelungsmittel ein erstes mit Gewinde versehenes Teil (6) und ein zweites mit Gewinde versehenes Teil (7), das über Gewinde mit dem ersten mit Gewinde versehenden Teil (6) verbunden ist, aufweisen, wobei das erste mit Gewinde versehene Teil (6) einen mit Gewinde versehenen Abschnitt (9) aufweist, der mit dem besagten mit Gewinde versehenen Abschnitt (5) des besagten Schaftes zusammenwirkt, wobei der besagte mit Gewinde versehene Abschnitt (9) des ersten Teiles (6) und der mit Gewinde versehene Abschnitt (4) der besagten inneren Bohrung (2) ausgelegt sind, um mit Gewinden der bezüglich der zusammenwirkenden mit Gewinde versehenen Abschnitte der besagten ersten und zweiten Teile (6, 7) entgegengesetzten Steigungsrichtung zusammenzuwirken, wodurch jegliche relative Verdrehung zwischen dem besagten mit Gewinde versehenen Abschnitt (4) des besagten Schaftes und einem vorgegebenen, damit verbundenen der besagten mit Gewinde versehenen Teile (6, 7) durch die gewindemäßige Verbindung zwischen dem ersten und dem zweiten mit Gewinde versehenen Teilen (6, 7) entgegengewirkt wird.

## Revendications

1. Ensemble à écrou de sécurité, comprenant un boulon à douille (1), un vis de serrage (6) et un boulon de sécurité (7) pour fixer des parties ensemble d'une manière à résister au desserrage,
  - 5 ledit boulon à douille (1) comprenant une tige creuse pourvue d'une partie taraudée (5) sur son extrémité libre, une tête (3), un alésage interne (2) s'étendant entre ladite tête (3) et ladite partie taraudée (5), ladite tête (3) étant formée avec une ouverture centrale alignée avec ledit alésage interne (2),
  - 10 ladite vis de serrage (6) présentant également une tige creuse et comprenant une partie taraudée (10) à une extrémité et une partie de tête (8) à son extrémité opposée,
  - 15 et un boulon de sécurité (7) qui présente une partie filetée (12) à une extrémité et une partie de tête (11) à son extrémité opposée,
  - 20 dans lequel ladite partie taraudée (10) de la tige de la vis de serrage (6) et la partie filetée extérieurement (12) du boulon de sécurité (7) sont d'une part dimensionnées pour coopérer avec les filets, caractérisé en ce qu'une partie (4) de l'alésage
  - 25 (2) dudit boulon à douille (1), adjacent à sa tête (3), est taraudée;
  - en ce que ladite vis de serrage (6) présente sur sa dite première extrémité, une partie filetée (9);
  - 30 dans lequel ladite partie filetée (9) de ladite vis de serrage (6) et ladite partie taraudée (4) dudit boulon à douille (1) sont dimensionnées pour coopérer avec des filetages orientés dans une direction opposée par rapport aux filetages de coopération desdites parties filetées (10, 12) de la vis de serrage (6) et du boulon de sécurité (7),
  - 35 de manière qu'en utilisation, la vis de serrage (6) puisse être vissée dans le boulon à douille (1), le boulon de sécurité (7) puisse être vissée dans la vis de serrage (6) via la tige creuse du boulon à douille (1) et suite au fait que les filetages respectifs qui coopèrent sont orientés dans des sens opposés, l'ensemble va résister à toute tendance à la désolidarisation.
  - 40 2. Ensemble selon la revendication 1, caractérisé en ce que la partie de tête (1) du boulon de sécurité (7) est pourvue d'un fil métallique (14) ou fixée d'une autre manière au boulon à douille (1), après serrage.
  - 45 3. Ensemble selon la revendication 2, caractérisé en ce que ladite partie de tête (11) est pourvue de deux fils métalliques (14) orientés dans un sens opposé.(figure 2a)
  - 50 4. Ensemble selon la revendication 2, caractérisé en ce que ladite partie de tête (11) est chanfreinée et une rondelle d'arrêt profilée (19) est placée sur cette partie ainsi qu' sur la partie de tête (3) du boulon à douille (1), ladit rondell (19) étant maintenu par un organe de fixation à force (22).
  - 55 5. Ensemble selon la revendication 1, caractérisé

en ce que la parti d tête (11) du boulon de sécurité (7) se présente sous la form d'une tête cylindriqu et est pourvu d'une gorge latérale circonférentielle (25) pour coopérer avec une goupille fendue (26).

6. Ensemble à écrou de sécurité, comprenant un boulon (1) pour fixer des parties ensemble de manière à résister au desserrage, ledit boulon (1) comprenant une tige creuse pourvue d'une partie taraudée (5), un alésage interne (2) et une tête (3), formée avec une ouverture centrale alignée avec ledit alésage interne (2), ce dernier étant pourvu d'une partie taraudée (4) et des moyens de sécurité (6, 7) pour ladite tige,

caractérisé en ce que ledit moyen de sécurité comprend un premier organe taraudé (6) et un second organe fileté (7), qui s'engage par son filetage dans le premier organe taraudé (6), ce dernier présentant une partie filetée (9) qui s'engage avec ladite partie taraudée (5) de ladite tige, ladite partie filetée (9) dudit premier organe (6) et la partie taraudée (4) dudit alésage interne (2) étant dimensionnées pour coopérer avec des filetages orientés dans une direction opposée par rapport aux parties filetées de coopération desdits premier et second organes (6, 7), de façon que toute rotation relative entre ladite partie taraudée (4) de ladite tige et un organe donné desdits organes filetés (6, 7) engagé avec cette partie, soit opposée à l'engagement par filetage entre lesdits premier et second organes (6, 7).

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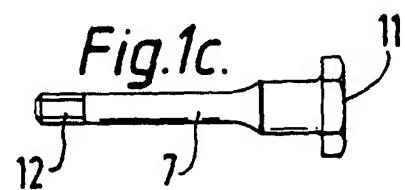
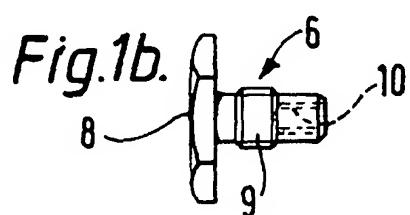
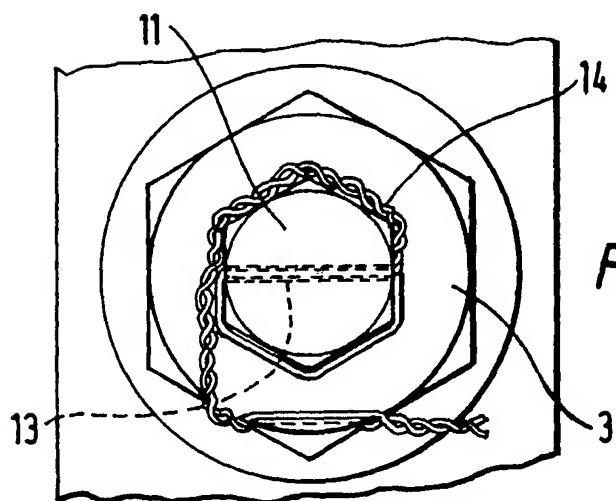
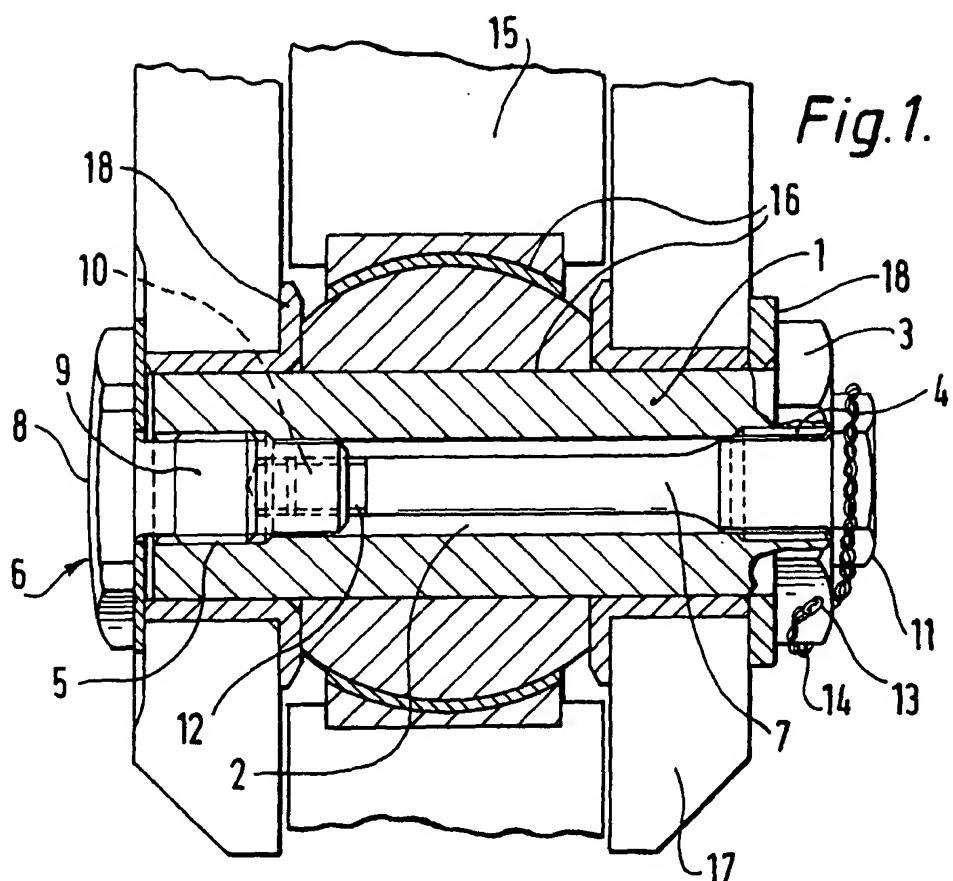
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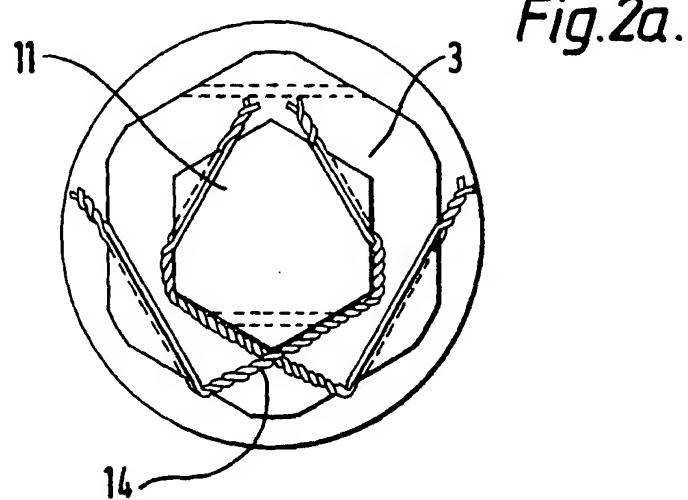
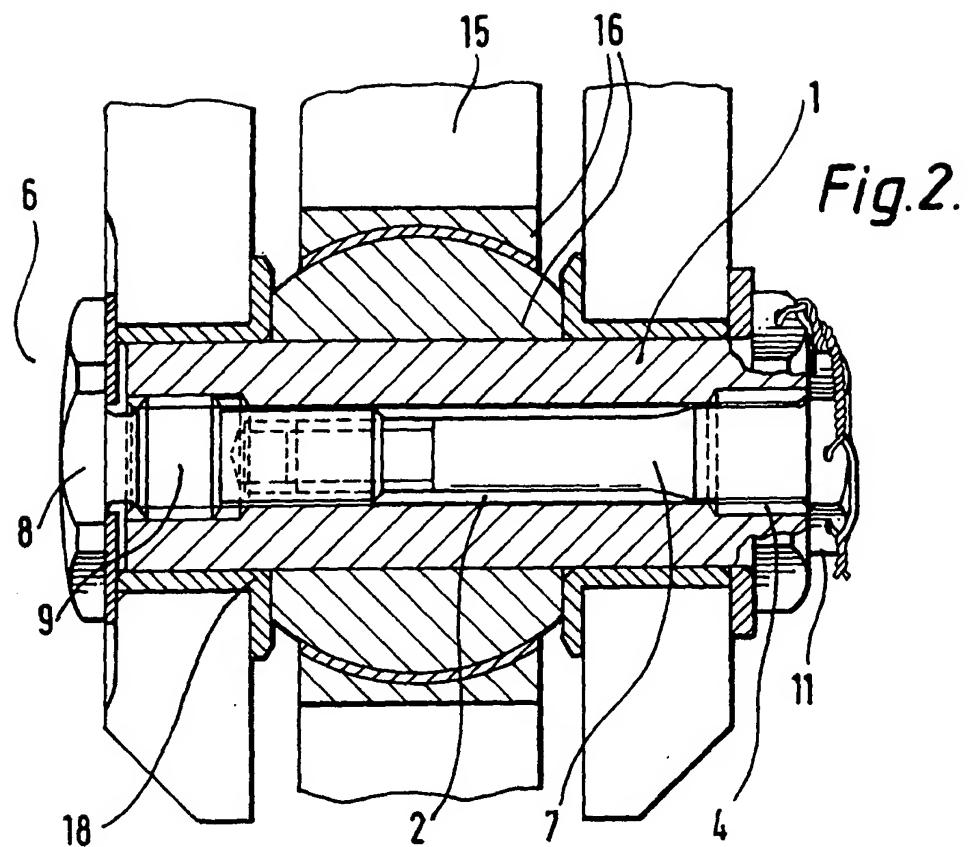
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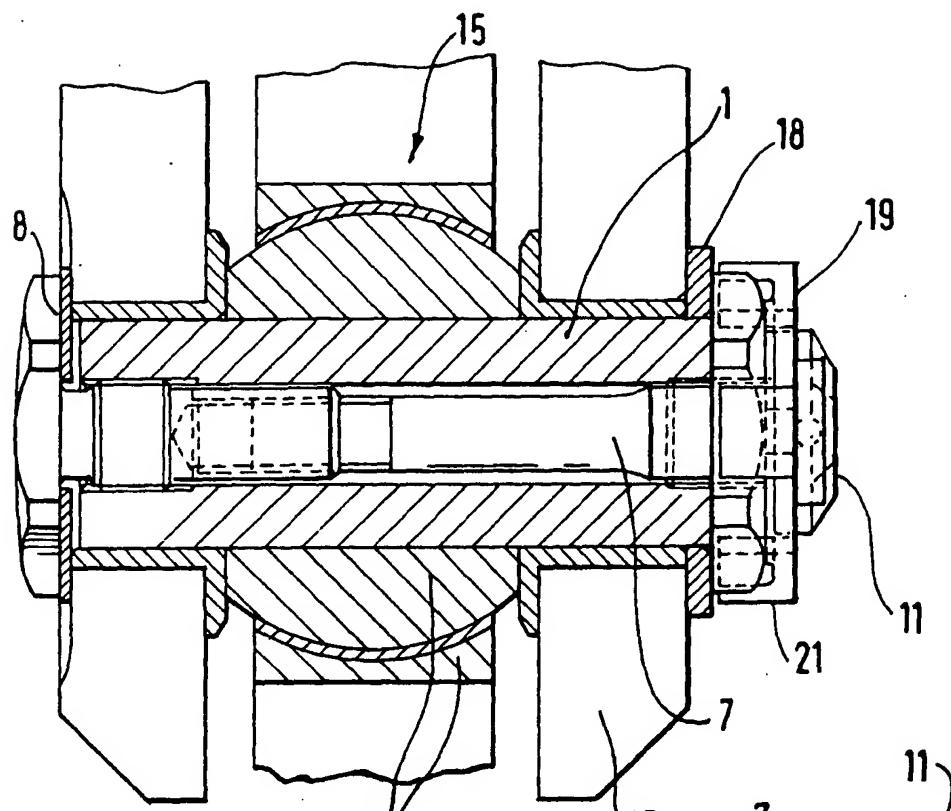


Fig. 3.

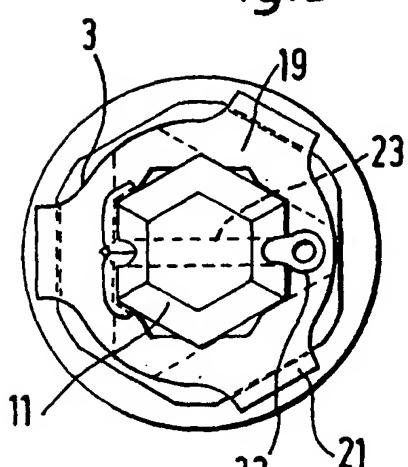


Fig. 3a.

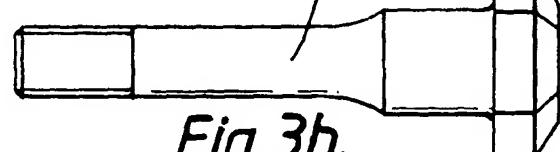


Fig. 3b.



Fig. 3c.

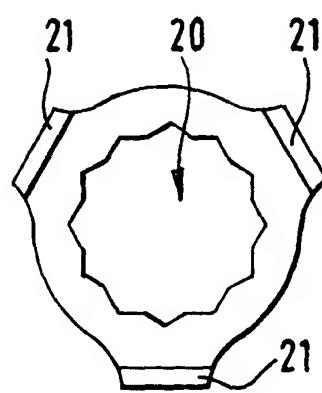


Fig. 3d.

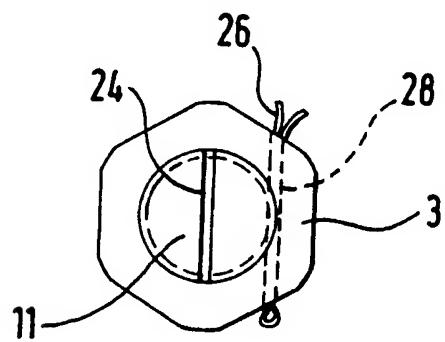
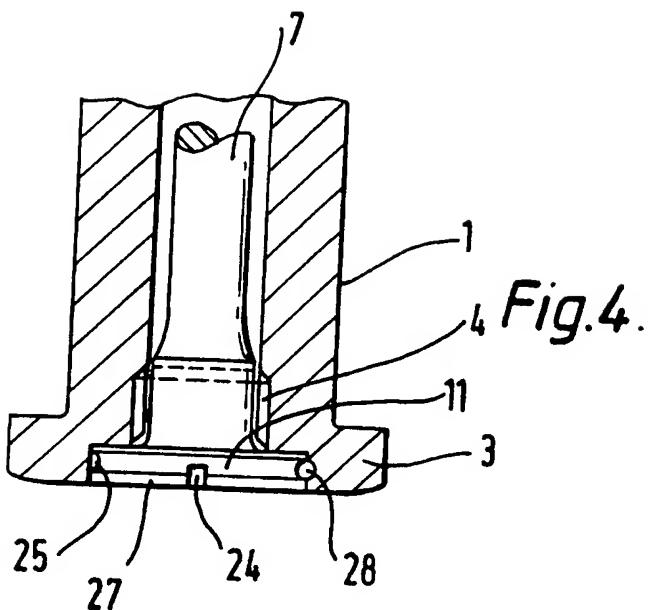


Fig. 4a.